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(57) Abstract

A network call center reduces terminating facilities for calls from customers to service agents, and provides the service agents with great flexibility as to where they may locate to service the calls. The network call center includes a network switch and an Automatic Call Distribution (ACD) server. The network switch receives calls from the customers, sends information regarding the call to the ACD server, and routes the calls to the service agents via local switches. The ACD server receives the information from the network switch, queues the customer calls, tracks service agent availability status, and controls the routing of the calls by the network switch. The ACD server instructs the network switch to route a call to one of the local switches only when one of the connected service agents is available to service the call.

NETWORK CALL CENTER

Background of the Invention

The present invention is directed to a network call center that provides customers with access to large virtual agent teams while reducing terminating facilities that drive the terminating access charges.

Many businesses use agents or operators to service customers by telephone. These businesses often employ several agents connected to an Automatic Call Distribution (ACD) system, such as a Meridian® ACD manufactured by Northern Telecom, Ltd., to handle multiple calls simultaneously. The call center technology distributes the calls (usually dialed with an 800 number) to the agents.

There are three principal types of call center technology: standalone ACDs, ACDs integrated with a Private Branch Exchange (PBX), and central office based ACDs. The most commonly used type is the ACD integrated with a PBX.

Fig. 1 shows a communications network containing conventional call center technology. Inter-Exchange Carrier (IXC) switch 1010, which can be multiple switches, interconnects customer 1100 with an agent, such as agents 1200 or 1300. Two agents have been shown for simplicity purposes. Typically multiple agents connect to a single or multiple switches.

Customer 1100 includes telephone 1110. When customer 1100 desires communication with an agent, such as agent 1200, a local class 5 telephone switch, designated as Equal Access End Office (EAEO) 1120, connects customer telephone 1110 to IXC switch 1010 over a Public Switched Telephone Network (PSTN) using a standard ISUP trunk.

Agent 1200 includes telephone 1210 and terminal 1220. ACD 1230 includes an EAEO/PBX switch that connects agent 1200 to IXC switch 1010 over the PSTN using an ISUP trunk, and connects to host computer 1240 using a Switch Computer Application Interface (SCAI) data channel, or a SCAI-equivalent data channel. Agent 1200 also communicates with host computer 1240 via agent terminal 1220.

In ACD systems, two independent call flow activities interact to provide the ACD functionality: agent tracking and call queuing. Agent 1200 logs onto the system and indicates his availability to receive calls by calling ACD 1230 using agent telephone 1210. ACD 1230 records which agents are currently logged onto the system and the status of such agents. The status includes data regarding the availability of a particular agent to take calls. When agent 1200 initially logs onto the system, ACD 1230 records his availability to service calls.

A customer, such as customer 1100, desiring to communicate with an agent for the service provided by a team of agents, including agent 1200, places a call using customer telephone 1110. Customer 1100 dials some toll-free number, and EAEO 1120 routes the call to IXC switch 1010, which in turn, routes the call to the appropriate

5   ACD. If a single ACD connects the entire team of agents, then IXC switch 1010 routes the call to that ACD. If, however, the agent team is connected to more than one ACD, IXC switch 1010 uses an internal algorithm, or an external computer, to select an ACD. IXC switch 1010 may use a "least busy ACD" algorithm, for example, to route the call to the ACD that has the least number of calls awaiting service.

10   ACD 1230 categorizes the call based on its call data. If an agent connected to ACD 1230 can service the call, then ACD 1230 routes the call to that agent. If not, ACD 1230 places the call in a queue. When the call reaches the top of the queue and an agent can service the call, ACD 1230 routes the call to the agent, such as agent 1200.

Upon receiving the call, agent 1200 retrieves information regarding the caller

15   from host computer 1240. Host computer 1240 records customer information, such as customer name and address, based on the telephone number from which the customer placed the call, or the customer's calling number. Agent 1200 then services the call.

When agent 1200 completes the call, he updates his status via agent telephone 1210 to indicate his availability to receive additional calls. ACD 1230 updates its records

20   accordingly.

At some point agent 1200 will log off of the system. When he does, agent 1200 informs ACD 1230 via agent telephone 1210 and ACD 1230 updates its records accordingly.

The conventional system described above suffers from a lack of flexibility

25   because the entire agent team must be connected to an ACD, though it need not be the same ACD, thereby restricting where the agents may be physically located. Also, queued calls can only be serviced by those agents of the agent team that connect to the ACD queuing the call without incurring the additional expense and network resources needed to forward the queued calls from the queuing ACD to one that is less busy.

30   Customers thus have limited access to the entire agent team pool, and normally have access only to the agents connected to the ACD queuing their calls. This increases the average wait time before an agent services a customer's call.

Moreover, the conventional system requires additional terminating facilities to queue calls and subjects the queued calls to unnecessary terminating access charges

35   because the calls are queued at a local switch.

Therefore, a need exists to provide agents with greater location flexibility to service calls, and to provide customers with more timely access to these agents while

reducing terminating facilities which in the conventional systems relate to terminating access charges.

Summary of the Invention

5   The present invention addresses this need by providing customers with access to a large virtual agent team that may be physically located almost anywhere. and by reducing terminating facilities by queuing customer calls at a higher level in the network than conventional systems. and providing connection into the local network only when an agent becomes available to service the call.

10   In accordance with the purpose of the invention as embodied and broadly described herein. the network call center according to the principles of the present invention reduces terminating facilities for customer calls to service agents. and provides the service agents with greater flexibility in where they may locate to service the calls. The network call center includes a network switch and an ACD server.

15   The network switch receives calls from the customers, sends information regarding the calls to the ACD server. and routes the calls to the service agents via local switches. The ACD server receives the information from the network switch. queues the calls, tracks service agent status. and controls the routing of the calls by the network switch. The ACD server instructs the network switch to route a call to one of the local

20   switches only when one of the connected service agents can service the call.

Brief Description of the Drawings

The accompanying drawings. which are incorporated in and constitute a part of this specification. illustrate an embodiment of the invention and. together with the

25   description, explain the objects, advantages and principles of the invention. In the drawings,

Fig. 1 is a diagram of a communications network containing conventional call center technology;

Fig. 2 is a diagram of a communications network containing the network call

30   center consistent with the principles of the present invention:

Fig. 3 is a diagram of the components of the network call center in one embodiment of the communications network depicted in Fig. 2:

Fig. 4 is a diagram of the components comprising the ACD Server of Fig. 3:

Fig. 5 is a flowchart of the agent set-up activity of the present invention

35   according to one embodiment;

Fig. 6 is a flowchart of the call servicing - call availability process of the present invention according to one embodiment:

Fig. 7 is a flowchart of the post-call activity of the present invention according to one embodiment;

Fig. 8 is a flowchart of the call queuing process of the present invention according to one embodiment;

Fig. 9 is a flowchart of the call servicing - agent availability process of the present invention according to one embodiment;

Fig. 10 is a flowchart of the agent log off activity of the present invention according to one embodiment;

Fig. 11 is a diagram of the components of the network call center in an alternative embodiment of the communications network depicted in Fig. 2; and

Fig. 12 is a diagram of the components comprising the High Level Switch of Fig. 11.

Detailed Description of the Preferred Embodiments

The following detailed description of the invention refers to the accompanying drawings that illustrate preferred embodiments consistent with this invention. Other embodiments are possible and changes may be made to the embodiments without departing from the spirit and scope of the invention. The following detailed description does not limit the invention. Instead, the scope of the invention is defined only by the appended claims.

The network call center consistent with the principles of the present invention provides customers with timely access to service agents by routing calls to any agent of a virtual team of agents whose physical location is immaterial, and reduces terminating facilities by queuing customer calls at a higher level in the network and routing one of the calls to the local network only when an agent becomes available to service the call.

I.   One Embodiment

Fig. 2 is a diagram of a communications network containing the network call center of the present invention. Network Call Center (NCC) 2010 connects customer 2100 to an agent of a virtual team of agents, including agents 2200 and 2300. One customer and two agents have been shown for simplicity purposes only. The present invention does not depend on a specific number of customers and agents, but encompasses any number of customers and agents connected to any switch in the network.

Customer 2100 uses a conventional telephone 2110 to communicate with an agent of the virtual agent team through NCC 2010. EAEO 2120 connects customer 2100 to NCC 2010 over a standard ISUP trunk, such as a GR394 ISUP trunk.

Multiple types of connections exist for connecting an agent of the virtual agent team to NCC 2010: (1) via a local switch having no ACD functionality; and (2) via a local switch having ACD functionality. Neither type of connection is preferred over the other. Business considerations and the physical locations of the agents play a role in making the decision as to which type of connection is best.

The communications network shown in Fig. 2 contains agents connected by both types of connections. To facilitate description of the invention, customer service by agents connected to the different types of connections will be described separately.

A. Local Switch Having No ACD Functionality

1. Network Elements

Agent 2200 includes terminal 2210 and connects to local EAEO/PBX switch 2220. EAEO/PBX 2220 is a standard class 5 switch without ACD functionality.

Agent terminal 2210 connects to EAEO/PBX 2220 using a voice channel and a data channel, and connects to host computer 2230 using a data channel. The data and voice channels may take many forms. For example, Fig. 2 shows agent 2200 connected to EAEO/PBX 2220 using a standard ISDN Basic Rate Interface (BRI) connection.

ISDN BRI provides two bearer (B) channels and one data (D) channel. The first B channel provides a voice connection to customer 2100 through NCC 2010. The second B channel provides other functions, such as setting up a data connection to host computer 2230 to obtain information regarding customer 2100 based on the calling telephone number. Alternatively, agent terminal 2210 may use the second B channel to access service data, such as a reservations database, using a conventional database access technique.

The D channel provides an X.25 data packet connection to NCC 2010 to inform NCC 2010 of agent availability. EAEO/PBX 2220 establishes the X.25 data packet connection with NCC 2010 through a public packet switching network. This data connection could alternatively be established by connection to an external data communication server which, in turn, relays the X.25 data packet to NCC 2010.

Other means for providing the connection to agent 2200 include telephone lines and coaxial television cable. Agent 2200 may use two telephone lines to establish the data and voice connections. A first telephone line provides a voice connection to customer 2100 through NCC 2010. The second telephone line provides a data connection to a data server (not shown). The data server, in turn, relays the data messages to NCC 2010 over private facilities using data communications technology, such as Ethernet. The data server also establishes a data connection with host computer 2230.

Alternatively, a coaxial television cable may be modified to provide the connection to agent 2200. In this case, the coaxial cable includes a voice channel to establish a voice connection to customer 2100 through NCC 2010. The same coaxial cable also provides data connections to NCC 2010 and host computer 2230.

As Fig. 2 shows, EAEO/PBX 2220 connects agent terminal 2210 to NCC 2010 using a standard ISUP trunk over the PSTN and an X.25 data connection. The data connection may also be an Ethernet connection. Agent terminal 2210 also connects to host computer 2230 via an X.25 data connection. Similar to the conventional systems, host computer 2230 contains information regarding the customer based on the calling telephone number.

Host computer 2230 preferably contains an X.25 data connection to NCC 2010 to provide NCC 2010 with customer information. Host computer 2230 could also have no data connection to NCC 2010, in which case host computer 2230 sends the customer information to agent terminal 2210 in response to an agent request.

Fig. 3 shows the components of NCC 2010 in one embodiment of the communications network depicted in Fig. 2. NCC 2010 preferably includes High Level Switch (HLS) 3010, ACD server 3020, and Interactive Voice Response unit (IVR) 3030.

HLS 3010 is a network switch, such as a DMS Traffic Operator Position System (TOPS) switch manufactured by Northern Telecom, Ltd. HLS 3010 routes calls from customer 2100 to an agent of a virtual team of agents, including agents 2200 and 2300. HLS 3010 preferably contains an interface that facilitates communication with ACD server 3020 to allow ACD server 3020 to control the routing of calls.

ACD server 3020 includes a computer with an Ethernet, or Ethernet-equivalent, data connection to HLS 3010 and IVR 3030. ACD server 3020 preferably comprises an IBM, or IBM compatible, computer executing Windows NTÔ, but might alternatively comprise a UNIXÔ-capable computer, such as an HP model or the IBM Risc 6000.

ACD server 3020 queues customer calls, records information regarding the availability of agents, controls the routing of calls by HLS 3010 and the operation of IVR 3030, and provides Management Information System (MIS) data. ACD server 3020 also processes network events reported by HLS 3010, and takes appropriate action, such as rerouting of calls and releasing of called trunks due to busy conditions, for example.

Fig. 4 shows the components of ACD server 3020 includes processing unit 4010, call buffer 4020, and agent buffer 4030. Processing unit 4010 tracks agent availability and handles the processing of customer calls, including the queuing of such calls in call buffer 4020 and the routing of these calls to available agents.

Call buffer 4020 preferably includes several call queues arranged by specific categories, such as by agent team, or by specific customer call criteria, such as the desired language of the customer. The call queues may also contain priority call queues for faster service by the agents. A call may be placed in a priority call queue, for

5   example, after it has waited in call buffer 4020 longer than a predetermined period of time.

Agent buffer 4030 preferably contains several agent queues arranged, for example, by agent team. Each agent queue contains values representing idle agents waiting for a call to service. Similar to the call queues, the agent queues may contain

10   priority agent queues that are searched first when a new call arrives needing service.

The particular queues within call buffer 4020 that an agent services or within agent buffer 4030 that an agent waits are predetermined by the operating telephone company, on behalf of the call center service provider. Agents may need to service multiple queues or just one queue. Agents may also need to service different queues at

15   different priorities.

Returning to Fig. 3, IVR 3030 includes a computer, such as a personal computer or a larger mainframe computer, with a voice connection to HLS 3010. IVR 3030 collects information from the customers to aid ACD server 3020 in categorizing the customer calls, storing them in a proper call queue in ACD server 3020, and directing

20   them to an appropriate agent. IVR 3030 also plays announcements or music for the customers while awaiting service in a call queue.

2.   Processing

Figs. 5-10 are flow charts illustrating the operation of the network call center of the present invention consistent with the principles of the invention.

25   Fig. 5 shows the steps that take place for agent set-up activity when an agent, such as agent 2200 in Fig. 3, wants to service customer calls. Agent 2200 sets up a connection with ACD server 3020 [step 5010] by turning on agent terminal 2210 and setting up an X.25 data packet connection to ACD server 3020 via EAEO/PBX 2220 by conventional means.

30   After establishing the connection, agent 2200 sends ACD server 3020 an X.25 log-on message, including an authorized agent identification number (ID) and a password [step 5020]. ACD server 3020 authenticates the agent ID and password [step 5030]. Once ACD server 3020 recognizes agent 2200 as an authorized agent, ACD server 3020 records that an additional agent is available to service customer calls [step

35   5040].

Once agent 2200 successfully logs onto the system, the call servicing - call availability process of the present invention shown in Fig. 6 occurs. Processing unit

4010 searches call buffer 4020 for a call waiting in a call queue assigned to the agent team that includes agent 2200 [step 6010], and determines whether there are any queued calls [step 6020].

If a call is waiting in the call queue, processing unit 4010 determines the directory number (DN) of available agent 2200 using data tables [step 6030]. The data tables contain information regarding the agents including their ID, password, DN, etc. and are predetermined by the operating telephone company on behalf of the call center service provider.

Processing unit 4010 instructs HLS 3010 to route the call to agent 2200 at the DN [step 6040]. HLS 3010 routes the call through the PSTN until it reaches the end office (*i.e.*, EAEO/PBX 2220) to which agent 2200 is connected. EAEO/PBX 2220 sends a standard call presentation message, such as an ISDN Q.931 call presentation message, to agent terminal 2210 to inform agent 2200 of the call arrival. Upon receiving the call, agent 2200 talks to customer 2100 and performs the desired service [step 6050].

When agent 2200 finishes servicing customer 2100, the post-call activity of the present invention shown in Fig. 7 occurs. At the end of the call, customer 2100 places customer telephone 2110 on-hook, thereby hanging up [step 7010]. HLS 3010 drops the voice connection between customer 2100 and agent 2200 [step 7020].

Once HLS 3010 drops the voice connection, agent 2200 completes any post-call work [step 7030], and then sends ACD server 3020 an X.25 message indicating his availability to service another call [step 7040]. ACD server 3020 records agent 2200's availability to receive additional calls [step 7050]. Once informed of agent 2200's availability, the call servicing process of Fig. 6 occurs again.

Returning to Fig. 6, if no calls are waiting in the call queue, processing unit 4010 places agent 2200 in the appropriate agent queue in agent buffer 4030 to await the arrival of a call needing service [step 6060], and the call queuing process of the present invention shown in Fig. 8 occurs.

When customer 2100 dials a telephone number for some service from an agent, EAEO 2120 reads the telephone number and routes the call to HLS 3010 [step 8010]. HLS 3010 sends information regarding the call to ACD server 3020 and the call itself to IVR 3030 [step 8020].

Processing unit 4010 in ACD server 3020 processes the call and categorizes it based on call information, such as calling number, called number, kind of calling phone, time of day, *etc.* [step 8030]. Based upon the categorization, processing unit 4010 selects a call queue in call buffer 4020 in which to place the call [step 8040].

While processing unit 4010 categorizes the call, IVR 3030 queries customer 2100 for additional information, such as a desired language or an account code, for

categorizing the call or aiding agents in servicing the customer [step 8050]. When IVR 3030 collects the requested information, it returns the information to processing unit 4010 [step 8060].

Based on the information received from IVR 3030, processing unit 4010
5   determines whether the previous call queue selection should be changed [step 8070]. If so, processing unit 4010 selects another call queue based on the information from IVR 3030 [step 8080]. Processing unit 4010 then assigns the call to the selected call queue [step 8090]. If processing unit 4010 determines that the previous call queue selection should not be changed, however, it assigns the call to the previously selected call queue
10 [step 8090].

While the call resides in call buffer 4020, IVR 3030 determines the projected wait time before the call will be serviced by an agent, and plays periodic announcements for customer 2100 indicating remaining wait time. Alternatively, IVR 3030 could inform customer 2100 of the projected wait time, offer to let customer 2100 go on-hook,
15 and keep the customer's place in the call queue if the projected wait time is more than a predetermined period of time. This causes customer 2100 to be "virtually queued." When an agent later becomes available, IVR 3030 automatically calls customer 2100 back using the calling party number supplied in customer 2100's call.

IVR 3030 could also play customized announcements or music for customer
20 2100 while the call is waiting in call buffer 4020. Even though IVR 3030 has been described as providing the customer announcements, these announcements may also be provided by ACD server 3020 or HLS 3010.

Once the call has been assigned to a call queue, the call servicing - agent availability process of Fig. 9 occurs. Processing unit 4010 searches the agent queue of
25 agent buffer 4030 for the service requested by the call [step 9010] to determine whether an agent is available to service the call [step 9020]. If no agent is available, the call queuing process of Fig. 8 occurs again.

If, on the other hand, agent 2200 can service the call, processing unit 4010 determines the directory number (DN) for agent 2200 using data tables [step 9030], and
30 instructs HLS 3010 to route the call to agent 2200 at the DN [step 9040].

HLS 3010 routes the call to agent 2200, and agent 2200 talks to customer 2100 and performs the desired service [step 9050]. When agent 2200 finishes servicing customer 2100, the post-call activity shown in Fig. 7 occurs again.

Eventually, agent 2200 will log off of the system by performing the agent log off
35 activity of the present invention shown in Fig. 10. Agent 2200 sends an X.25 log off message to ACD server 3020 to indicate agent 2200's desire to log off of the system [step 10010].

Upon receiving the log off message, ACD server 3020 records that one fewer agent is available to service calls [step 10020]. ACD server 3020 then drops its connection with agent 2200 [step 10030], logging agent 2200 off of the system.

B.   Local Switch Having ACD Functionality

1.   Network Elements

5   Returning to Fig. 2, agent 2300 includes terminal 2310 connected to a conventional ACD 2320 by conventional means. ACD 2320 contains a voice connection to NCC 2010 using a standard ISUP trunk, and a data connection using a data channel such as Ethernet. In such an arrangement, NCC 2010 effectively networks existing

10   ACDs together.

This arrangement provides customers with all the existing ACD features, such as local MIS and agent assistance, in addition to the benefits described above.

2.   Processing

Agent 2300 logs into ACD 2320, as in conventional systems, but also logically

15   logs into NCC 2010. Agent 2300 then becomes logically connected to two systems and reports agent status to both systems.

NCC 2010 receives incoming calls, queues them if necessary, and provides queued calls with announcements and music at a higher level in the network. ACD 2320 informs NCC 2010 when agent 2300 becomes available, and NCC 2010 routes the call

20   to ACD 2320 to which agent 2300 is connected. Once delivered, standard ACD functionality takes over. Agent 2300 is immediately connected and services the call.

II.   Alternative Embodiment

While the ACD server has been described as queuing the customer calls, this need not be the case. Fig. 11 shows the communications network of Fig. 2 containing a

25   network call center in an alternative embodiment consistent with the principles of the present invention.

A.   Network Elements

Customer 2100 and agents 2200 and 2300 connect to the network in a similar manner as that described above with regard to Fig. 2. NCC 2010 includes High Level

30   Switch (HLS) 11010, ACD server 11020, and Interactive Voice Response unit (IVR) 11030.

HLS 11010 is a network switch, such as a DMS TOPS switch manufactured by Northern Telecom. Ltd. HLS 11010 queues and routes calls between customer 2100 and agents 2200 and 2300. Fig. 12 shows the components of HLS 11010 include

35   Queue Management System (QMS) 12010, call buffer 12020, and agent buffer 12030.

QMS 12010 handles the processing of customer calls including the queuing of such calls in call buffer 12020 and the routing of these calls to available agents. QMS

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12010 preferably contains software. such as Operator Services System Advanced Intelligent Network (OSSAIN) software, that facilitates communication with ACD server 11020 to allow ACD server 11020 to control HLS 11010. Call buffer 12020 and agent buffer 12030 are similar to those described above with regard to Fig. 4.

Returning to Fig. 11, ACD server 11020 preferably includes a computer with an Ethernet, or Ethernet-equivalent data connection to HLS 11010. ACD server 11020 preferably comprises an IBM, or IBM compatible. computer executing Windows NTÔ. but might alternatively comprise a UNIXÔ-capable computer. such as an HP model or the IBM Risc 6000.

ACD server 11020 informs HLS 11010 regarding the availability of agents. controls the routing of calls to those agents. and provides Management Information System (MIS) data. ACD server 11020 also processes network events reported by HLS 11010. and takes appropriate action. such as rerouting of calls and releasing of called trunks due to busy conditions. for example.

IVR 11030 preferably comprises a computer. such as a personal computer or a larger mainframe computer, with both data and voice connections to HLS 11010. Even though Fig. 11 shows IVR 11030 as a separate unit, IVR 11030 may be located within HLS 11010.

IVR 11030 collects information from the customers to aid HLS 11010 in categorizing the customer calls, storing them in a proper call queue in HLS 11010, and directing them to an appropriate agent. IVR 11030 also plays announcements or music for the customers while awaiting service in a call queue.

B.   Processing

The network call center in the alternative embodiment consistent with the principles of the present invention performs operations similar to the network call center operations described with regard to Figs. 5-10. However. as described above, ACD server 11020 no longer queues customer calls, but instead. HLS 11010 performs this operation. ACD server 11020 still performs agent tracking and informs HLS 11010 regarding the availability of a particular agent to service customer calls.

III.   Conclusion

The network call center provides several advantages over the conventional call center technology:

(1) Call center service providers no longer need to locate their agents close to a PBX or special switch having ACD functionality. Agents can even be located at home.

(2) Terminating access facilities are reduced because calls queue at a higher level in the network. leading to a reduction in terminating access charges.

(3) Call queuing efficiency is maximized because agents can be located anywhere and still serve the same call queue without using extra network resources. This provides customers with more timely access to a service agent by creating a virtual team of agents.

5   The foregoing description of preferred embodiments of the present invention provides illustration and description, but is not intended to be exhaustive or to limit the invention to the precise form disclosed. Modifications and variations are possible in light of the above teachings or may be acquired from practice of the invention. For example, the Network Call Center could reside in an IXC switch. Also, the ACD server

10   could record and provide to the call center service provider billing information regarding the call, such as the duration of talk time and post-call wrap-up time. The scope of the invention is defined by the claims and their equivalents.

Claims

1.   A call routing system comprising:

a plurality of customer switches, connected to customers, for directing call information to and from the customers;

a plurality of agent switches, coupled to service agents, for directing call information to and from the service agents;

network switching means, connected to the customer switches and the agent switches, for receiving customer calls, determining information from the customer calls, and for routing the customer calls to the service agents via the agent switches; and

Automatic Call Distribution (ACD) server means, connected to the network switching means and the agent switches, for receiving the information from the network switching means, for queuing the customer calls, for tracking a status of the service agents, and for controlling the network switching means to route the customer calls to the appropriate service agents via the agent switches.

2.   The system of claim 1, wherein the ACD server means includes

means for receiving the information from the network switching means;

means for queuing the customer calls based on the information;

means for monitoring the status of the service agents; and

means for causing the network switching means to route a customer call to an agent switch only when the service agent coupled to that agent switch is available to service the customer call.

3.   The system of claim 1, wherein the agent switches include means for providing ACD functionality.

4.   The system of claim 1, wherein the ACD server means comprises

an agent buffer including a plurality of agent queues for storing values corresponding to available ones of the service agents; and

processing means for storing the values in the agent queues.

5.   The system of claim 4, wherein the ACD server means further comprises

a call buffer including a plurality of call queues for storing customer calls awaiting service, the processing means stores the waiting customer calls in the call queues.

6.   The system of claim 5, wherein the call queues are arranged by predetermined categories; and

wherein the processing means includes

means for categorizing the customer calls according to the predetermined categories, and

means for storing each of the categorized customer calls in a corresponding one of the call queues.

7.   The system of claim 6, further comprising interactive voice response means, connected to the network switching means and the ACD server means, for
5   querying the customers for customer information; and
        wherein the categorizing means includes
            means for using the customer information to categorize the customer calls.

8.   The system of claim 1, further comprising
10   interactive voice response means, connected to the network switching means and the ACD server means, for querying the customers for information regarding the customer calls.

9.   The system of claim 1, wherein the ACD server means includes one of an Ethernet and an Ethernet-equivalent connection to the network switching
15   means.

10.   A call routing system comprising:
        a plurality of customer switches, connected to customers, for directing call information to and from the customers;
        a plurality of agent switches, coupled to service agents, for directing call
20   information to and from the service agents;
        network switching means, connected to the customer switches and the agent switches, for receiving customer calls, for queuing the customer calls, and for routing the customer calls to the service agents via the agent switches; and
        Automatic Call Distribution (ACD) server means, connected to the network
25   switching means and the agent switches, for tracking a status of the service agents and for controlling the network switching means to route the customer calls to the appropriate service agents via the agent switches.

11.   The system of claim 10, wherein the ACD server means includes
        means for monitoring the status of the service agents; and
30   means for causing the network switching means to route a customer call to an agent switch only when the service agent coupled to that agent switch is available to service the customer call.

12.   The system of claim 10, wherein the agent switches include means for providing ACD functionality.

35   13.   The system of claim 10, wherein the network switching means comprises
        an agent buffer including a plurality of agent queues for storing values corresponding to available ones of the service agents; and

queue manager means for storing the values in the agent queues.

14.   The system of claim 13, wherein the network switching means further comprises

a call buffer including a plurality of call queues for storing customer calls awaiting service, the queue manager means stores the waiting customer calls in the call queues.

15.   The system of claim 14, wherein the call queues are arranged by predetermined categories; and

wherein the queue manager means includes

means for categorizing the customer calls according to the predetermined categories, and

means for storing each of the categorized customer calls in a corresponding one of the call queues.

16.   The system of claim 15, further comprising

interactive voice response means, connected to the network switching means, for querying the customers for customer information; and

wherein the categorizing means includes

means for using the customer information to categorize the customer calls.

17.   The system of claim 10, further comprising

interactive voice response means, connected to the network switching means, for querying the customers for information regarding the customer calls.

18.   A method of routing calls from customers, connected to customer switches, to service agents, connected to agent switches, via a network switch controlled by an Automatic Call Distribution (ACD) server, the method, performed in the ACD server, comprising the steps of:

receiving information regarding a customer call, received at the network switch from one of the customers via a corresponding customer switch, from the network switch;

queuing the customer call based on the received information;

determining an available one of the service agents;

determining routing instructions; and

instructing the network switch to route the customer call to the determined available service agent via a corresponding agent switch according to the determined routing instructions.

19.   The method of claim 18, wherein the agent switches are ACD switches providing ACD functionality; and

wherein the determining step for determining an available one of the service agents includes the substep of

receiving service agent availability notification from one of the ACD switches indicating that one of the service agents is available to service the 5   customer call.

20.   The method of claim 18, wherein the ACD server includes a call buffer having a plurality of call queues arranged by predetermined categories for storing customer calls; and

wherein the queuing step includes the substeps of

10   categorizing the customer call based on information included with the customer call, and

storing the categorized customer call in a corresponding call queue.

21.   The method of claim 20, wherein an interactive voice response unit is connected to the network switch and the ACD server and queries the customer for

15   customer information; and

wherein the categorizing substep includes the substep of

using the customer information from the interactive voice response unit to categorize the customer call.

22.   The method of claim 18, wherein the ACD server includes an agent buffer

20   having a plurality of agent queues for storing values corresponding to available ones of the service agents; and

wherein the determining step for determining an available one of the service agents includes the substep of

searching the agent queues for an available service agent.

25   23.   The method of claim 18, wherein the agent switches are ACD switches providing ACD functionality; and

wherein the instructing step includes the substep of

instructing the network switch to route the customer call to the determined available service agent via a corresponding ACD switch according to

30   the routing instructions.

24.   A method of routing calls from customers, connected to customer switches, to service agents, connected to agent switches, via a network switch controlled by an Automatic Call Distribution (ACD) server, the method, performed in the network switch, comprising the steps of:

35   receiving a customer call from one of the customers via a corresponding customer switch;

queuing the customer call;

determining an available one of the service agents;

notifying the ACD server of the determined available service agent;

receiving routing instructions from the ACD server; and

5   routing the customer call to the determined available service agent via a corresponding agent switch according to the routing instructions.

25. The method of claim 24, wherein the agent switches are ACD switches providing ACD functionality; and

     wherein the determining step includes the substep of

10   receiving service agent availability notification from an ACD switch indicating that one of the service agents is available to service the customer call.

26. The method of claim 24, wherein the network switch includes a call buffer having a plurality of call queues arranged by predetermined categories for storing customer calls; and

15   wherein the queuing step includes the substeps of

         categorizing the customer call based on information included with the customer call, and

         storing the categorized customer call in a corresponding call queue.

27. The method of claim 26, wherein an interactive voice response unit is

20 connected to the network switch and queries the customer for customer information; and

     wherein the categorizing substep includes the substep of

         using the customer information from the interactive voice response unit to categorize the customer call.

28. The method of claim 24, wherein the network switch includes an agent

25 buffer having a plurality of agent queues for storing values corresponding to available ones of the service agents; and

     wherein the determining step includes the substep of

     searching the agent queues for an available service agent.

29. The method of claim 24, wherein the agent switches are ACD switches

30 providing ACD functionality; and

     wherein the routing step includes the substep of

         routing the customer call to the determined available service agent via a corresponding ACD switch according to the routing instructions.

30. A method for permitting available service agents, connected to agent

35 switches, to service calls from customers, connected to customer switches, the customer switches and the agent switches connected via a network switch controlled by an Automatic Call Distribution (ACD) server, the method, performed in the ACD server,

comprising the steps of:

receiving a log-in request from an available service agent:

· recording that the available service agent can service customer calls:

searching call queues for the presence of a customer call awaiting service:

5   determining routing instructions for the available service agent; and

instructing the network switch to route the customer call to the available service agent via a corresponding agent switch according to the routing instructions.

31.   The method of claim 30, wherein the agent switches comprise ACD switches providing ACD functionality; and

10   wherein the instructing step includes the substep of

instructing the network switch to route the customer call to the available service agent via a corresponding ACD switch.

32.   The method of claim 30, further comprising the step of

placing the available service agent in at least one agent queue of a plurality of

15   agent queues when there is no customer call waiting in the call queues.

33.   A method for permitting available service agents, connected to agent switches, to service calls from customers, connected to customer switches, the customer switches and the agent switches connected via a network switch controlled by an Automatic Call Distribution (ACD) server, the method comprising the steps of:

20   receiving a log-in request at the ACD server from an available service agent:

informing the network switch that the available service agent can service customer calls:

searching call queues in the network switch for the presence of a customer call awaiting service:

25   informing the ACD server of the waiting customer call: ·

determining routing instructions for the available service agent in the ACD server: and

instructing the network switch to route the customer call to the available service agent via a corresponding agent switch according to the routing instructions.

30   34.   The method of claim 33, wherein the agent switches comprise ACD · switches providing ACD functionality: and

the method further including the step of

routing the customer call to the available service agent via a corresponding ACD switch.

35   35.   The method of claim 33, further comprising the step of

placing the available service agent in at least one agent queue of a plurality of · agent queues in the network switch when there is no customer call waiting in the call

queues.

36.   A method for permitting available service agents, connected to Automatic
Call Distribution (ACD) switches providing ACD functionality, to service calls from
customers connected to customer switches, the customer switches and the ACD switches
5 . being connected via a network switch controlled by an ACD server, the method,
performed in the ACD server, comprising the steps of:

receiving notification that a service agent is available from a corresponding ACD
switch;

searching call queues for the presence of a customer call awaiting service;
10   determining routing instructions for the available service agent; and

instructing the network switch to route the customer call to the available service
agent via the corresponding ACD switch according to the routing instructions.

37.   A method for permitting available service agents, connected to Automatic
Call Distribution (ACD) switches that provide ACD functionality, to service calls from
15   customers connected to customer switches, the customer switches and the ACD switches
being connected via a network switch controlled by an ACD server, the method
comprising the steps of:

receiving notification that a service agent is available at the network switch from
a corresponding ACD switch;
20   searching call queues in the network switch for the presence of a customer call
awaiting service:

informing the ACD server of the waiting customer call:

determining routing instructions for the available service agent in the ACD
server; and
25   routing the customer call to the available service agent via the corresponding
ACD switch according to the routing instructions.

38.   A system for creating a virtual team of service agents comprising:

a plurality of agent switches, connected to a team of service agents, for providing
Automatic Call Distribution (ACD) functionality and for routing customer calls to the
30   service agents, the service agents performing a service in response to the customer calls;

a network switch, connected to the agent switches, for receiving the customer
calls, determining information from the calls, and routing the customer calls to the
service agents via the agent switches: and

an ACD server, connected to the network switch and the agent switches, for
35   receiving the information from the network switch, for queuing the customer calls,
tracking a status of the service agents, and controlling the network switch such that the
network switch routes a customer call to any service agent of the service agent team that

is available to perform the service.

39.   A system for creating a virtual team of service agents comprising:

a plurality of agent switches, connected to a team of service agents, for providing Automatic Call Distribution (ACD) functionality and for routing customer calls to the
5   service agents, the service agents performing a service in response to the customer calls;

a network switch, connected to the agent switches, for receiving the customer calls, queuing the customer calls, and routing the customer calls to the service agents via the agent switches; and

an ACD server, connected to the network switch and the agent switches, for
10   tracking a status of the service agents and for controlling the network switch such that the network switch routes a customer call to any service agent of the service agent team that is available to perform the service.

40.   A network call center for reducing terminating facilities for service calls from customers to service agents comprising:

15   a network switch, connected to the customers via customer switches and to the service agents via agent switches, configured to receive the service calls, determine information from the service calls, and route the service calls to the service agents via the agent switches; and

an Automatic Call Distribution (ACD) server, connected to the network switch
20   and the agent switches, configured to receive the information from the network switch, queue the service calls, track service agent status, and control the routing of the service calls by the network switch, the ACD server instructing the network switch to route a service call to one of the agent switches only when one of the connected service agents can service the service call.

25   41.   The network call center of claim 40, wherein the agent switches comprise ACD switches that provide ACD functionality; and

wherein the ACD server comprises

means for receiving notification that a service agent is available from the ACD switch to which the service agent is connected.

30   42.   The network call center of claim 41, wherein the network switch further comprises

means for routing the service call to the available service agent via the ACD switch.

43.   The network call center of claim 40, further comprising
35   an interactive voice response unit, connected to the network switch and the ACD server, for querying the customers for information regarding the service calls and for playing customer announcements while the service calls are queued in the ACD server.

44.   A network call center for reducing terminating facilities for service calls
from customers to service agents comprising:

        a network switch. connected to the customers via customer switches and to the
service agents via agent switches. configured to receive and queue the service calls, and
5   to route the service calls to the service agents via the agent switches; and

        an Automatic Call Distribution (ACD) server, connected to the network switch
and the agent switches. configured to track service agent status and control the routing of
the service calls by the network switch. the ACD server instructing the network switch
to route a service call to one of the agent switches only when one of the connected
10   service agents can service the service call.

        45.   The network call center of claim 44, wherein the agent switches comprise
ACD switches that provide ACD functionality; and

        wherein the network switch comprises

                means for receiving notification that a service agent is available from the
15   ACD switch to which the service agent is connected.

        46.   The network call center of claim 45, wherein the network switch further
comprises

                means for routing the service call to the available service agent via the
ACD switch.

20   47.   The network call center of claim 44, further comprising

        an interactive voice response unit, connected to the network switch, for querying
the customers for information regarding the service calls and for playing customer
announcements while the service calls are queued in the network switch.

        48.   In a network that routes calls from customers. connected to customer
25   switches, to service agents. connected to agent switches, via a network switch controlled
by an Automatic Call Distribution (ACD) server, the network switch comprising:

        means for receiving a customer call from one of the customers via a
corresponding customer switch;

        means for sending information regarding the call to the ACD server;
30   means for receiving routing instructions from the ACD server; and

        means for routing the customer call to the available service agent via a
corresponding agent switch according to the routing instructions.

        49.   In a network for routing calls from customers. connected to customer
switches, to service agents, connected to agent switches, via a network switch controlled
35   by an Automatic Call Distribution (ACD) server. the ACD server comprising:

        means for receiving a log-in request from an available one of the service agents;

means for recording that the available service agent can service customer calls;

means for determining the presence of a customer call awaiting service;

means for determining routing instructions for the available service agent; and

means for instructing the network switch to route the customer call to the
5   available service agent via a corresponding agent switch according to the routing
instructions.

50.   In a network that routes calls from customers, connected to customer
switches, to service agents, connected to agent switches, via a network switch controlled
by an Automatic Call Distribution (ACD) server, the network switch comprising:
10   means for receiving a customer call from one of the customers via a
corresponding customer switch;

means for queuing the customer call;

means for determining an available one of the service agents;

means for notifying the ACD server of the available service agent;
15   means for receiving routing instructions from the ACD server; and

means for routing the customer call to the available service agent via a
corresponding agent switch according to the routing instructions.

51.   In a network for routing calls from customers, connected to customer
switches, to service agents, connected to agent switches, via a network switch controlled
20   by an Automatic Call Distribution (ACD) server, the ACD server comprising:

means for receiving a log-in request from an available one of the service agents;

means for informing the network switch that the available service agent can
service customer calls;

means for receiving notification from the network switch of a customer call
25   awaiting service;

means for determining routing instructions for the available service agent; and

means for instructing the network switch to route the customer call to the
available service agent via a corresponding agent switch according to the routing
instructions.

FIG. 1
(PRIOR ART)

FIG. 2

FIG. 3

FIG. 4

AGENT SET-UP ACTIVITY

```
┌─────────────────────────────────┐  5010
│   Agent sets up connection with │
│          ACD Server             │
└─────────────────────────────────┘
                │
                ▼
┌─────────────────────────────────┐  5020
│  Agent sends ACD Server an       │
│  authorized agent ID and password│
└─────────────────────────────────┘
                │
                ▼
┌─────────────────────────────────┐  5030
│                                 │
│  ACD Server authenticates agent │
│  ID and password                │
└─────────────────────────────────┘
                │
                ▼
┌─────────────────────────────────┐  5040
│   ACD Server records that an    │
│  additional agent is available  │
│  to receive calls               │
└─────────────────────────────────┘
                │
                ▼
             ( A )
```
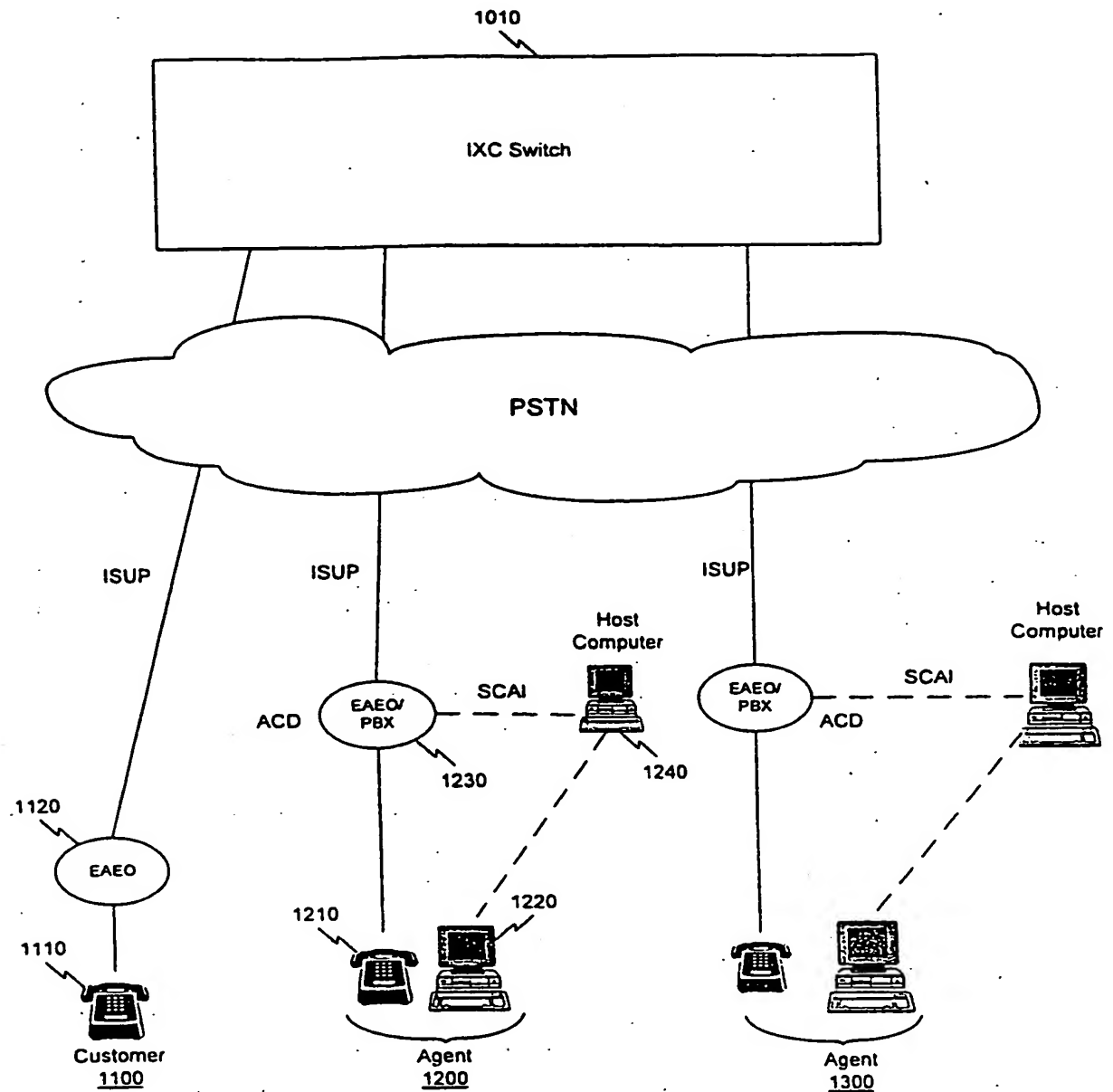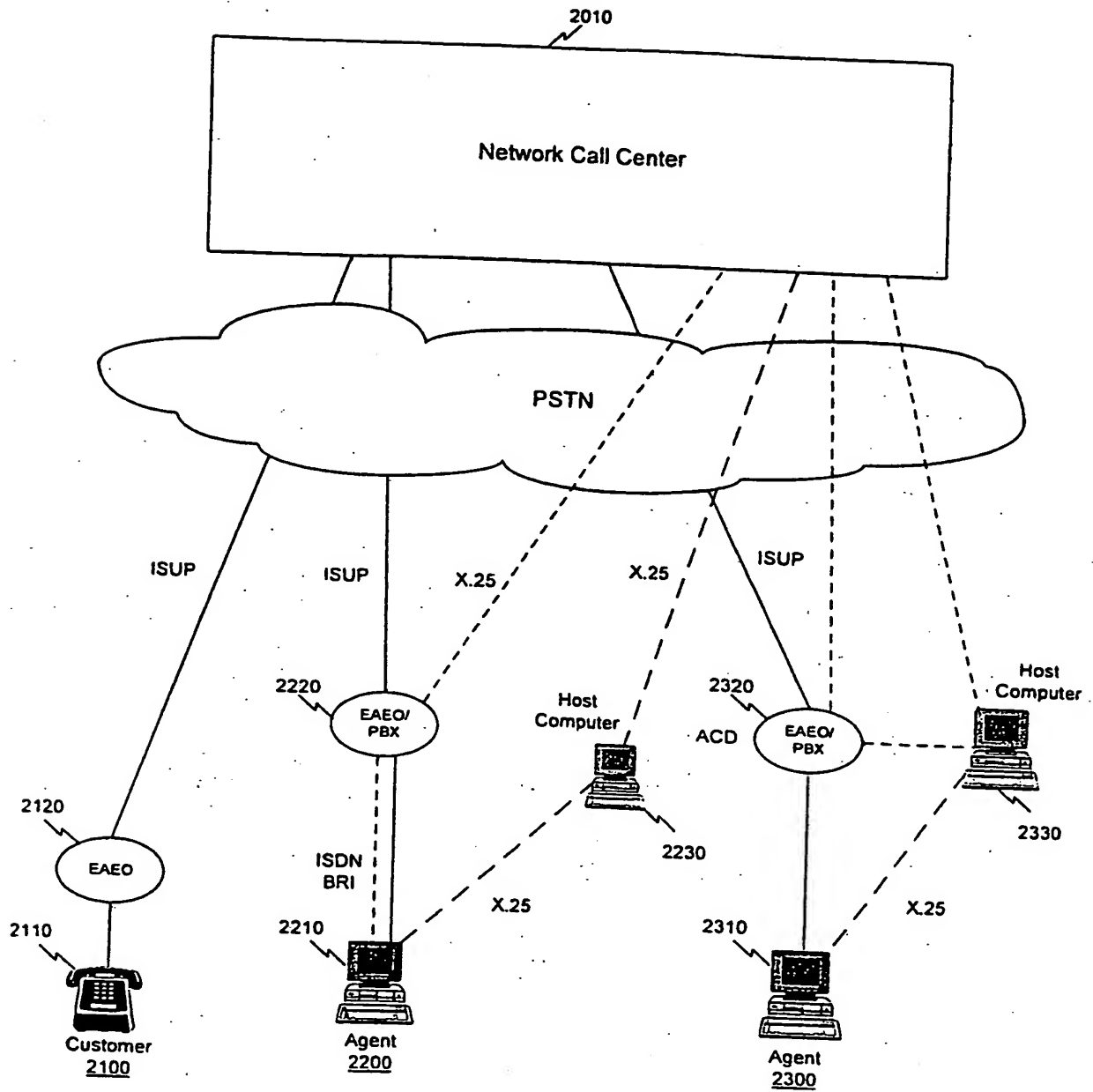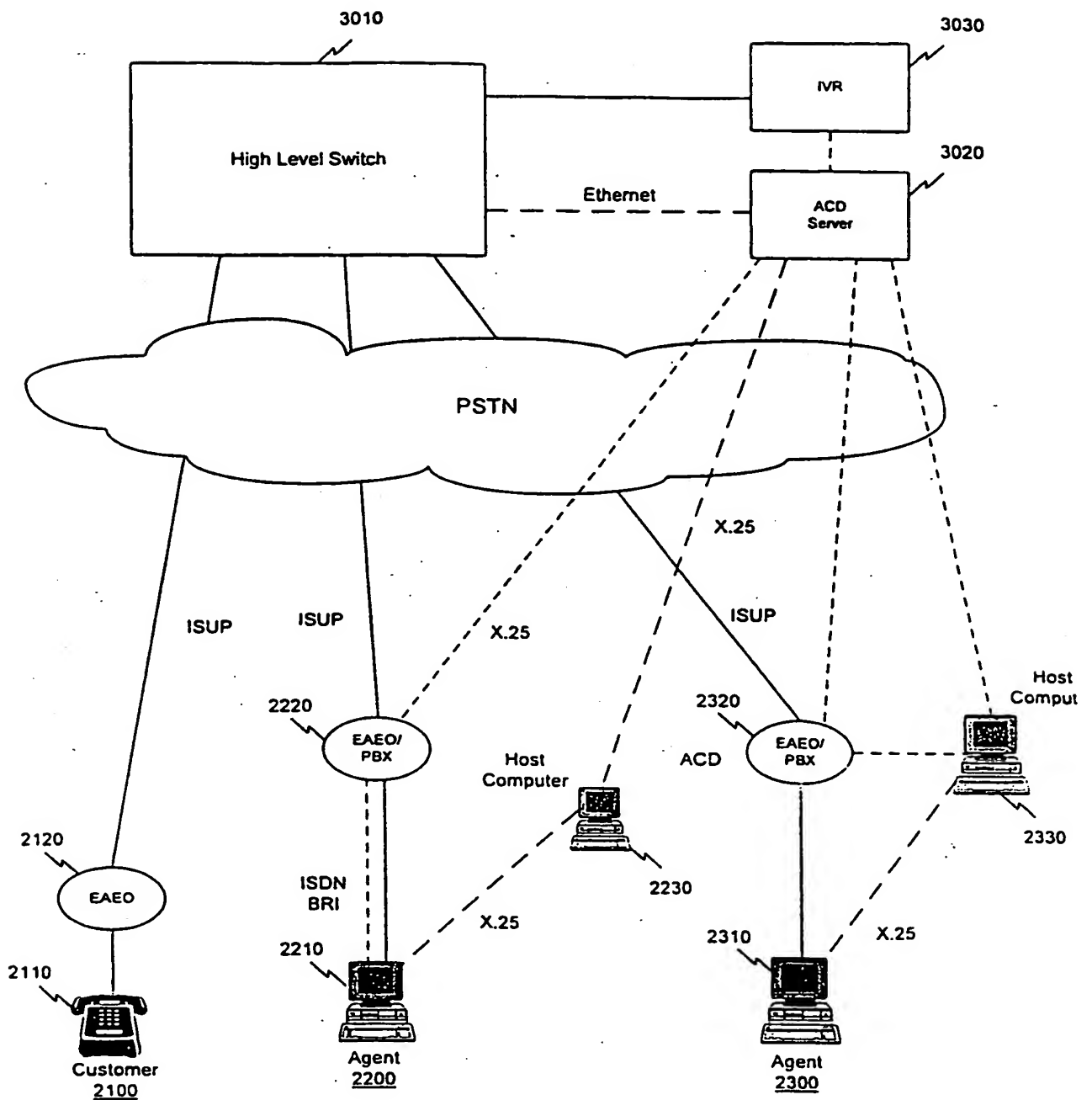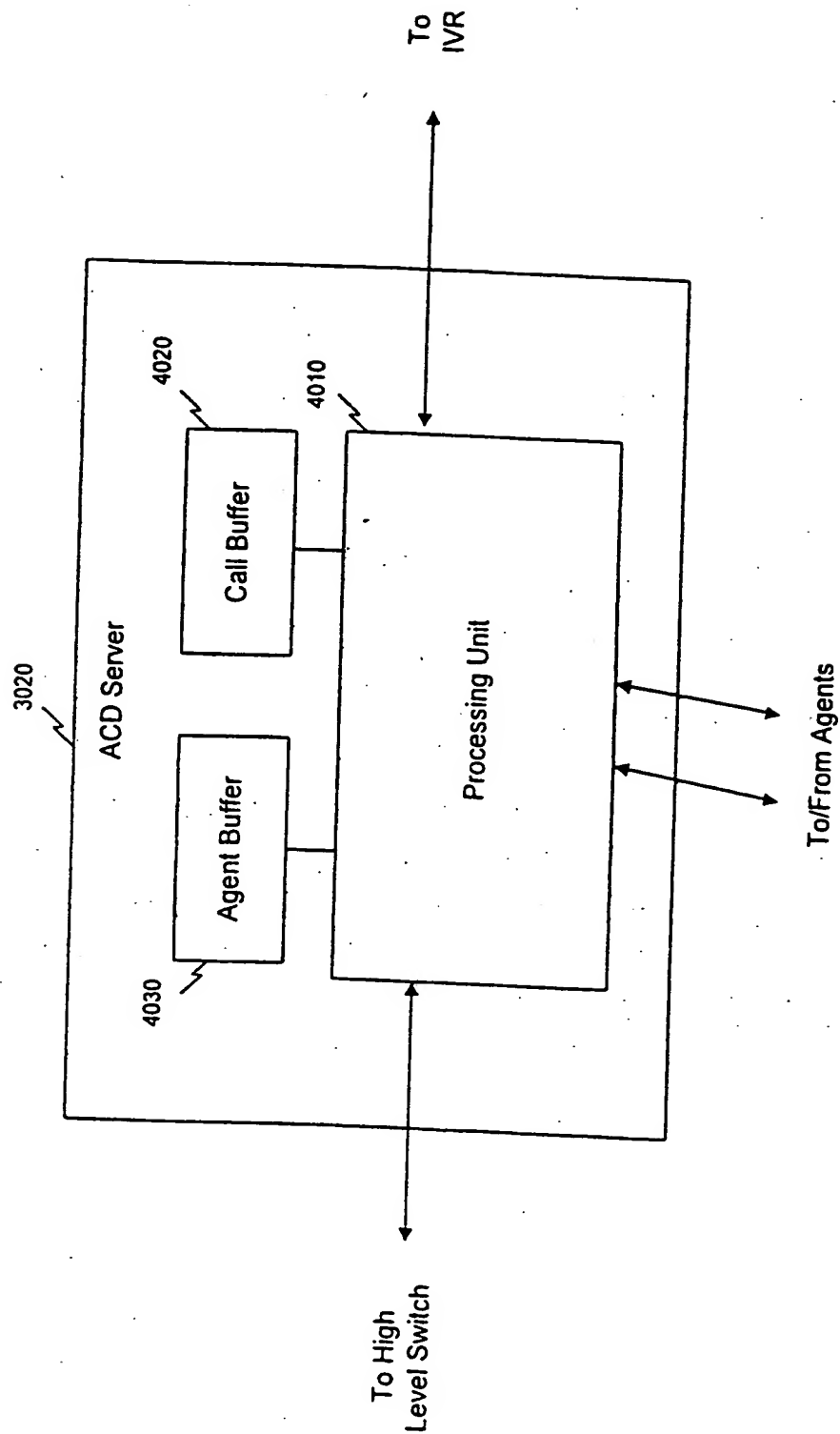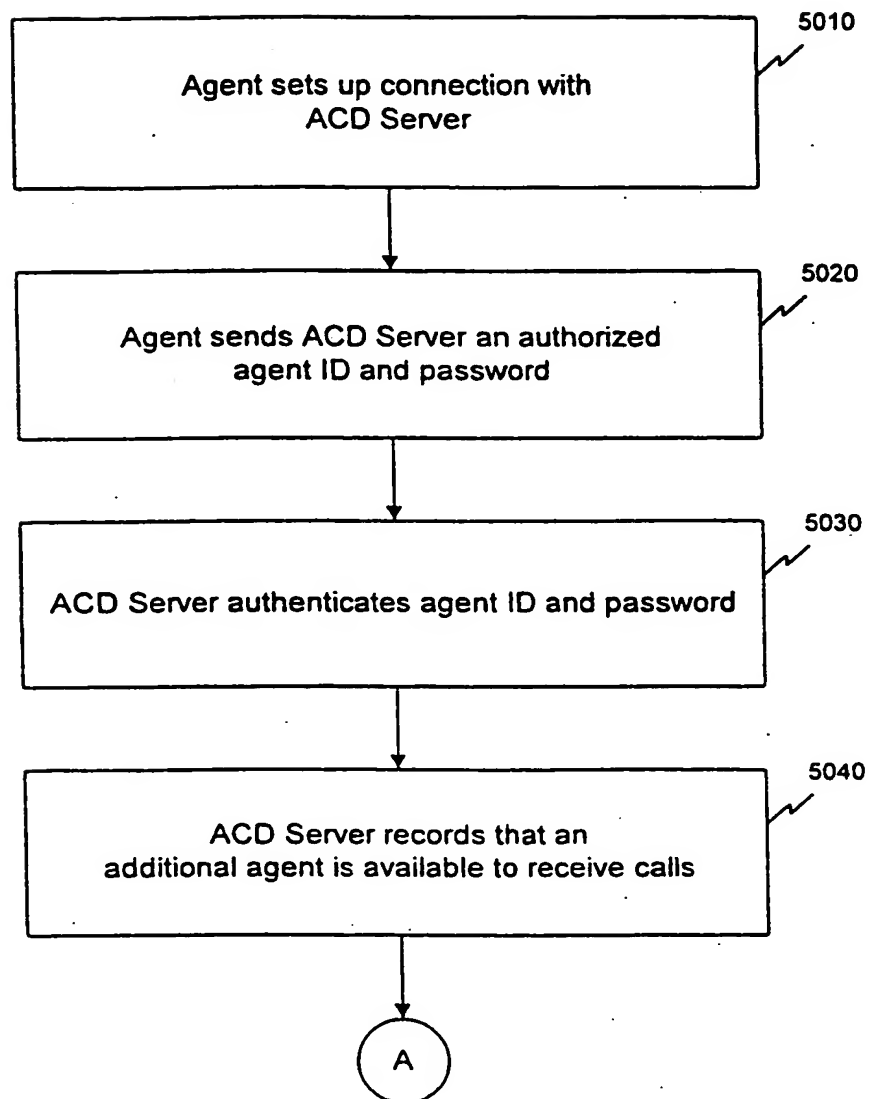
FIG. 5

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CALL SERVICING - CALL AVAILABILITY

FIG. 6

POST-CALL ACTIVITY

(B)

```
Customer hangs up                                    7010

High Level Switch drops voice connection to agent    7020

Agent completes post-call work                       7030

Agent informs ACD Server that agent is
again available to service calls                     7040

ACD Server records that the agent is
available to receive calls                           7050
```

(A)

FIG. 7

CALL QUEUING

C

Call arrives at High Level Switch — 8010

High Level Switch sends call information to ACD Server and call to IVR — 8020

8030 — Processing Unit processes and categorizes call

8050 — IVR solicits customer for additional information

Processing Unit selects a call queue for the call based on its categorization

IVR returns the information to the Processing Unit

8040

8060

8070 — Should selected call queue be changed based on information from IVR?

YES

NO

8080 — Processing Unit selects another call queue based on IVR information

8090 — Processing Unit assigns call to selected call queue

D

FIG. 8

CALL SERVICING - AGENT AVAILABILITY

```
                    ┌───┐
                    │ D │
                    └───┘
                      │
                      ▼
        ┌─────────────────────────────┐  9010
        │ Processing Unit searches     │
        │ agent queues                 │
        │ for available agent          │
        └─────────────────────────────┘
                      │
                      ▼
              ◇─────────────◇  9020
             ╱               ╲           NO      ┌───┐
            ◇ Any agent      ◇──────────────────▶│ C │
             ╲ available?    ╱                    └───┘
              ◇─────────────◇
                    │
                   YES
                    │
                    ▼
        ┌─────────────────────────────┐  9030
        │ Processing Unit determines   │
        │ the directory                │
        │ number (DN) of available     │
        │ agent                        │
        └─────────────────────────────┘
                    │
                    ▼
        ┌─────────────────────────────┐  9040
        │ Processing Unit instructs    │
        │ High Level Switch            │
        │ to route call to agent at DN │
        └─────────────────────────────┘
                    │
                    ▼
        ┌─────────────────────────────┐  9050
        │ Agent services call          │
        └─────────────────────────────┘
                    │
                    ▼
                  ┌───┐
                  │ B │
                  └───┘
```

FIG. 9

AGENT LOG OFF ACTIVITY

```
┌────────────────────────────────────────────────────┐
│                                                      │  10010
│  Agent informs ACD Server that agent is logging off  │
│                                                      │
└────────────────────────────────────────────────────┘
                          │
                          ▼
┌────────────────────────────────────────────────────┐
│                                                      │  10020
│     ACD Server records that one fewer agent is       │
│          available to receive calls                  │
│                                                      │
└────────────────────────────────────────────────────┘
                          │
                          ▼
┌────────────────────────────────────────────────────┐
│                                                      │  10030
│       ACD Server drops connection with agent         │
│                                                      │
└────────────────────────────────────────────────────┘
```

FIG. 10

FIG. 11

FIG. 12